form of the doctrine of transmutation would force us to the same conclusion. But the eloquent words in which Tyndall* refers to Mayer, may, in our opinion, be equally applied to our illustrious countryman. "He deals with true causes: and the only question "that can affect his theory refers to the quantity of action "which he has ascribed to these causes. I do not pledge myself to "this theory, nor do I ask you to accept it as demonstrated: still, it "would be a great mistake to regard it as chimerical. It is a noble "speculation; and, depend upon it, the true theory, if this or some "form of it be not the true one, will not appear less wild or less "astounding."

Though the opinions of Sir Charles Lyell concerning the Antiquity of Man may not be generally adopted, we might at least expect them to be known by all those who undertake to write upon the present state of Science. It is surprising, therefore, that Dr. Cumming, ("Moses Right and Bishop Colenso Wrong," Part 7, page 138), should, so lately as last month, have cited Sir Charles Lyell as an authority for the recent appearance of Man upon the earth. The Doctor is, however, not very particular in his use of authorities. Thus (p. 33) he quotes Buckland's "Reliquiæ Diluvianæ" as Geological evidence in favour of a universal deluge; and, in p. 50, he parodies Scripture as follows:—"If Bishop Colenso had "believed Buckland, and Professor Sedgwick, and Professor Hitchcock, he would "have believed in Moses; but as he does not believe in their evidence, how can he "believe in what Moses records?" Buckland, however, long ago abandoned the views advocated in the above-mentioned work, Sedgwick will be surprised to find himself quoted as believing that there are any geological evidences of a universal deluge, and not only does Professor Hitchcock agree with Bishop Colenso as to the non-universality of the deluge, but Dr. Cumming knew this at the time he wrote; for, in the very next page, he says "Professor Hitchcock, from whom "I have largely quoted,—a thoroughly Christian man,—also believes that the "flood was not universal."

As ignorant apparently of Latin as of Geology, Dr. Cumming regards the grooves and furrows, or, as he calls them, "the *scoriæ*,"—the italics are not ours —"upon the stones at Brora, for instance, in Sutherlandshire, and in other parts "of the kingdom" (p. 48), as evidences of the Mosaic Deluge!

XVII.—Contributions to an Insect Fauna of the Amazon Valley. By Henry Walter Bates, Esq. Transact. Linnean Soc. Vol. XXIII. 1862, p. 495.

The author reveals some curious facts in this memoir, which from its unpretending and somewhat indefinite title we fear may be overlooked in the ever-flowing rush of scientific literature. The main subject discussed is the extraordinary mimetic resemblance which certain butterflies present to other butterflies belonging to distinct groups. To appreciate the degree of dissimulation practised by these insects, it is necessary to study the beautiful plates with which the memoir is adorned. In a district where, for instance, an *Ithomia* abounds in gaudy swarms, another butterfly, namely a *Leptalis*, will often be found mingled in the same flock, so like the *Ithomia* in every

* Heat considered as a mode of motion, p. 426.

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shade and stripe of colour and even in the shape of its wings, that Mr. Bates, with his eyes sharpened by collecting during eleven years, was, "though always on my guard," continually deceived. When the mockers and the mocked are caught and compared they are found to be totally different in essential structure, and to belong not only to distinct genera, but often to distinct families. If this mimicry had occurred in only one or two instances, it might have been passed over as a strange coincidence. But travel a hundred miles, more or less, from a district where one *Leptalis* imitates one *Ithomia*, and a distinct mocker and mocked, equally close in their resemblance, will be found. Coloured drawings of seven mocking forms of *Leptalis*, and six mocked forms of *Ithomia*, and one of another genus are given. Altogether no less than ten genera are enumerated, which include species that imitate other butterflies. The mockers and mocked always inhabit the same region; we never find an imitator living remote from the form which it counterfeits. The mockers are almost invariably rare insects; the mocked in almost every case abound in swarms. In the same district in which a species of *Leptalis* closely imitates an *Ithomia*, there are sometimes other Lepidoptera mimicking the same *Ithomia;* so that in the same place, species of three genera may be found all closely resembling a species of a fourth genus. It is highly remarkable that even moths, notwithstanding their dissimilarity in structure and general habits of life, sometimes so closely imitate butterflies (these butterflies being simultaneously mocked by others) that, as Mr. Bates says, when "seen on the wing in their native woods, they deceive the most experienced eye." These several facts and relations carry the strongest conviction to the mind that there must be some intimate bond between the mocking and mocked butterflies. It may, however, be naturally asked, why is the one considered as the mocked form; and why are the others, or two or three other butterflies which inhabit the same district in scanty numbers, considered as the mockers? Mr. Bates satisfactorily answers this question, by showing that the form which is imitated keeps the usual dress of the group to which it belongs, whilst the counterfeiters have changed their dress and do not resemble their nearest allies.

In these facts, of which only a brief abstract has been given, we have the most striking case ever recorded of what naturalists call analogical resemblance. By this term naturalists mean the resemblance in shape, for instance, of a whale to a fish—of certain snake-like Batrachians to true snakes—of the little burrowing and social pachydermatous *Hyrax* to the rabbit, and other such cases. We can understand resemblances, such as these, by the adaptation of different animals to similar habits of life. But it is scarcely possible to extend this view to the variously coloured stripes and spots on butterflies; more especially as these are known often to differ greatly in the two sexes. Why then, we are naturally eager to know, has one butterfly or moth so often assumed the dress of another quite distinct form; why to the perplexity of naturalists has Nature condescended

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to the tricks of the stage? We remember only one statement, made by Mr. Andrew Murray in his excellent paper on the Disguises of Nature, namely that insects thus imitating each other usually inhabit the same country, which combined with the fact of the imitators being rare and the imitated common, might have given a clue to the problem. Mr. Bates has given to these facts the requisite touch of genius, and has, we cannot doubt, hit on the final cause of all this mimicry. The mocked and common forms must habitually escape, to a large extent, destruction, otherwise they could not exist in such swarms; and Mr. Bates never saw them preyed on by birds and certain large insects which attack other butterflies; he suspects that this immunity is owing to a peculiar and offensive odour that they emit. The mocking forms, on the other hand, which inhabit the same district, are comparatively rare, and belong to rare groups; hence they must suffer habitually from some danger, for from the number of eggs laid by all butterflies, without doubt they would, if not persecuted, in three or four generations swarm over the whole country. Now if a member of one of these persecuted and rare groups were to assume a dress so like that of a well-protected species that it continually deceived the practised eyes of an ardent entomologist, it would often deceive predacious birds and insects, and thus escape entire annihilation. This we fully believe is the true explanation of all this mockery.

Mr. Bates truly observes, that the cases of one butterfly mocking another living butterfly do not essentially differ from the innumerable instances of insects imitating the bark of trees, lichens, sticks, and green leaves. Even with mammals, the hare on her form can hardly be distinguished from the surrounding withered herbage. But no case is known of a deer or antelope so like a tiger as to deceive a hunter; yet we hear from Mr. Bates of insects more dissimilar than a ruminant and carnivore, namely, of a cricket most closely resembling a *cicindela*—a veritable tiger amongst insects. Amongst birds, all that habitually squat on the ground in open and unprotected districts, resemble the ground, and never have gaudy plumage. It appears, however, that two cases of birds mocking other birds have been observed by that philosophical naturalist, Mr. Wallace. Amongst insects, on the other hand, in all parts of the world, there are innumerable cases of imitation; Mr. Waterhouse has noted an excellent instance (and we have seen the specimens) of a rare beetle inhabiting the Philippine Archipelago, which most closely imitates a very common kind belonging to a quite distinct group. The much greater frequency of mockery with insects than with other animals, is probably the consequence of their small size; insects cannot defend themselves, excepting indeed the kinds that sting, and we have never heard of an instance of these mocking other insects, though they are mocked: insects cannot escape by flight from the larger animals; hence they are reduced, like most weak creatures, to trickery and dissimulation.

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By what means, it may be asked, have so many butterflies of the Amazonian region acquired their deceptive dress? Most naturalists will answer that they were thus clothed from the hour of their creation—an answer which will generally be so far triumphant that it can be met only by long-drawn arguments; but it is made at the expence of putting an effectual bar to all further inquiry. In this particular case, moreover, the creationist will meet with special difficulties; for many of the mimicking forms of *Leptalis* can be shown by a graduated series to be merely varieties of one species; other mimickers are undoubtedly distinct species or even distinct genera. So again, some of the mimicked forms can be shown to be merely varieties; but the greater number must be ranked as distinct species. Hence the creationist will have to admit that some of these forms have become imitators, by means of the laws of variation, whilst others he must look at as separately created under their present guise; he will further have to admit that some have been created in imitation of forms not themselves created as we now see them, but due to the laws of variation! Prof. Agassiz, indeed, would think nothing of this difficulty; for he believes that not only each species and each variety, but that groups of individuals, though identically the same, when inhabiting distinct countries, have been all separately created in due proportional numbers to the wants of each land. Not many naturalists will be content thus to believe that varieties and individuals have been turned out all ready made, almost as a manufacturer turns out toys according to the temporary demand of the market.

There are some naturalists, who, giving up to a greater or less extent the belief of the immutability of species, will say that as the mocked and mocking forms inhabit the same district, they must have been exposed to the same physical conditions, and owe to this circumstance their common dress. What direct effect the physical conditions of life, that is, climate with all its contingencies and the nature of the food, produce on organic beings is one of the most abstruse problems in natural history, and cannot be here discussed. But we may remark that when a moth closely resembles a butterfly, or better still, when a cricket resembles a *Cicindela*, it becomes very difficult to believe that insects so widely dissimilar in their internal structure and habits of life, should have had their external organization alone so largely influenced by their conditions of life as to become almost identical in appearance. Can we believe that one insect comes to resemble the bark of a tree; another a green leaf; another in its larval condition the dead twig of a branch; or that a quail or snipe comes to resemble the bare ground on which it lies concealed, through the direct action of the physical conditions of life? If in these cases, we reject this conclusion, we ought to reject it in the case of the insects which mock other insects.

Assuredly something further is required to satisfy our minds: what this something is, Mr. Bates explains with singular clearness

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and force. He shows that some of the forms of *Leptalis*, whether these be ranked as species or varieties, which mimick so many other butterflies, vary much. In one district several varieties (which are figured) occur; one alone of these pretty closely resembles the common *Ithomia* of the same district. In a few other cases, this *Leptalis* presents two or three varieties, one of which is much commoner than the others, and this alone mocks an *Ithomia*. In several cases a single *Leptalis*, which sometimes must be ranked, according to the usual rules followed by naturalists, as a variety and sometimes as a distinct species, mocks the common *Ithomia* of the district. From such facts as these, Mr. Bates concludes that in every case the *Leptalis* originally varied; and that when a variety arose which happened to resemble any common butterfly inhabiting the same district (whether or no that butterfly be a variety or a so-called distinct species) then that this one variety of the *Leptalis* had from its resemblance to a flourishing and little persecuted kind a better chance of escaping destruction from predacious birds and insects, and was consequently oftener preserved;—"the less perfect degrees of resemblance being generation after generation eliminated, and only the others left to propagate their kind." This is Natural Selection. Mr. Bates extends this view, supporting it by many facts and forcible arguments, to all the many wonderful cases of mimickry described by him. He adds, "thus, although we are unable to watch the process of formation of a new race as it occurs in time, we can see it, as it were, at one glance, by tracing the changes a species is simultaneously undergoing in different parts of the area of its distribution."

To the naturalist who is interested with respect to the origin of species, the most important parts of this Memoir, together with the descriptive portion at the end, are probably those which treat on the limits of species, on sexual variation, on the variation of important characters, such as the neuration of the wings, &c. We cannot here discuss these points. Mr. Bates shows that there is a perfect gradation in variability, from butterflies, of which hardly two can be found alike, to slight varieties, to well-marked races, to races which can hardly be distinguished from species, to true and good species. Under this point of view, the history of *Mechanitis polymnia* well deserves study: after describing its several varieties, Mr. Bates adds, "these facts seem to teach us that, in this and similar cases, a new species originates in a local variety, formed in a certain area, where the conditions are more favourable to it than to the typical form, and that a large number of such are simultaneously in process of formation from one variable and widely distributed species." It is hardly an exaggeration to say, that whilst reading and reflecting on the various facts given in this Memoir, we feel to be as near witnesses, as we can ever hope to be, of the creation of a new species on this earth.

We will only notice briefly one other point which has an important bearing on the production of new races and species; namely the

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statement repeatedly made that in certain cases the individuals of the same variety evince a strong predilection to pair together. We do not wish to dispute this statement; it has been affirmed by credible authors, that two herds of differently coloured deer long preserved themselves distinct in the New Forest; and analogous statements have been made with respect to races of sheep in certain Scotch islands; and we know no reason why the same may not hold good with varieties in a state of nature. But we are by our profession as critics bound to be sceptical, and we think that Mr. Bates ought to have given far more copious evidence. He ought also to have given in every case his reasons in full for believing that the closely allied and co-existing forms, with which his varieties do *not* pair, are not distinct species. Naturalists should always bear in mind such cases as those of our own willow wrens, two of which are so closely alike that experienced ornithologists can with difficulty distinguish them, excepting by the materials of which their nests are built; yet these are certainly as distinct species as any in the world.

We think so highly of the powers of observation and reasoning shown in this Memoir, that we rejoice to see by the advertisements that Mr. Bates will soon publish an account of his adventures and his observations in natural history, during his long sojourn in the magnificent valley of the Amazon. We believe that this work will be full of interest to every admirer of Nature.

XVIII.—Prodromus Monographiae Scitaminearum, additis nonnullis de Phytographia, de Monocotyleis et Orchideis. Auctore P. Horaninow. Petropoli. 1862.

The Family of Scitamineæ has never attracted so much of the attention of cultivators as have the Orchids, so that our stores do not contain such ample means of studying its species as are afforded in the case of the latter Family. Unfortunately, too, (as is also the case with Orchids), the species of this Order dry badly, the foliage affords but little aid in discriminating species, and the flowers are, generally, extremely delicate in texture, and so much compressed in the process of drying, that it is most difficult to get a satisfactory knowledge of the shape and structure of the corolla and anthers.

The position of our author is not at all favourable for the preparation of an exhaustive monograph of a family which cannot be studied to advantage in the Herbarium, so that we have no right to look to him for that great desideratum. This work will, however, be very useful as a carefully compiled *resumé* of the species of the Order, and it will be of great use to any botanist who may be able to undertake, under more favourable conditions, a critical examination of the species. The flowers (like those of Orchids) vary very much, and the study of the species in their native habitats, and cultivated side by side in the

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